Second Designs and Cost Estimates
for Storage Ring Dipoles and Quadrupoles

When the first designs for these magnets, summarized in LS-12, were
reviewed, it was decided to change two of the design criteria. These new
criteria are:

1. Retain the original aperture dimensions but increase the maximum
    operating energy by 25%; and

2. Permit ALL insertion device straight sections to be able to accept either
    type of device.

The result of No. 1 above is to increase the flux density in the yoke at
the maximum operating point and increase the coil size for the dipole
magnet. The quadrupole yokes were increased in size to keep the flux density
less than 15kG but the coils were not changed.

When applying criteria 2. above, five different quadrupoles immediately
result. Quads QD4 and QF5 are also similar enough to group as a single magnet
type.

The gap and MAXIMUM operating parameters are summarized in Table I for
the resulting storage ring dipole and quadrupole types.

Table I
Storage Ring Magnets
Gap Parameters and MAXIMUM Operating ΔT

Magnet Type	Number Req'd	L (m)	B or B'(NOM) (T) or (T/m)	Aperture (cm)	B or B'(MAX) (T) or (T/m)	ΔT(MAX) (°C)
M	64	2.95	0.6661	6.5H x 14W	0.8326	18
QD1	64	0.7	4.292	6.5 dia	5.5	1
QF2/QF7	64	1.0	18.385	6.5 dia	23.0	19
QD3/QD6	64	0.7	17.649	6.5 dia	23.0	11
QD4/QF5	128	0.7	10.863	6.5 dia	13.6	4

The computer program MADEST was used to calculate the design parameters for the nominal operating conditions and to estimate the costs. These results are summarized in Table II.

Table II
Storage Ring Magnets
Second Design NOMINAL Operating
Parameters and Total Costs

Magnet Type	Number Req'd	Current (A)	Voltage (V)	ΔT (°C)	Total Magnet Mass (Tonne)	Total Power (kW)	Total Water Flow (gpm)	Total Cost (1985K$)
M	64	792	13.2	11.6	352	671	221	2186
QD1	64	401	1.3	0.6	13	33	200	1039
QF2	32	477	8.2	11.8	48	126	41⎫	1560
QF7	32	228	3.9	2.7	48	28	40⎭	
QD3	32	458	5.7	6.6	35	83	48⎫	1422
QD6	32	309	3.8	3.0	35	38	48⎭	
QD4	64	292	2.3	1.3	38	43	122⎫	2573
QF5	64	423	3.4	2.8	38	91	123⎭	
Totals for Ring					607	1113	843	8780

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